Capsular Management in Hip Arthroscopy

Joshua D. Harris, MD[a,b]

KEYWORDS

• Iliofemoral ligament • Hip capsule • Capsulotomy • Capsular repair
• Capsular plication • Capsular reconstruction • Zona orbicularis • Microinstability

KEY POINTS

- The iliofemoral ligament is the strongest component of the hip capsule but is divided (perpendicular) with the interportal capsulotomy.
- Capsular repair (of either the interportal or T capsulotomy) restores rotational and translational biomechanics of the hip joint.
- Greater degrees of plication may be titrated in patients with risk factors for postoperative instability (Ehlers-Danlos, connective tissue disorders, ballet dancers, gymnastics, yoga).
- Sufficient capsular incision is necessary to achieve the osseous (impingement) and soft tissue (chondrolabral) goals of the arthroscopic hip preservation procedure.

INTRODUCTION

Arthroscopic hip preservation is one of the most rapidly growing and evolving fields in orthopedic surgery. Variable degrees of capsular incision are required for joint access, visualization, and instrumentation. Controversy exists regarding the type, size, and location of capsulotomy necessary to properly address central and peripheral compartment pathology. Controversy does not exist regarding the necessity to correct symptomatic femoroacetabular impingement (FAI) osseous morphology. The surgeon must be able to visualize the morphology in order to treat it. Closure, plication, shift, and reconstruction are a few options available to address the capsulotomy at the conclusion of the surgery. However, this component of capsular management is technically challenging and requires meticulous technique for optimal outcomes.

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[a] Department of Orthopedics & Sports Medicine, Houston Methodist Hospital Institute for Academic Medicine, 6550 Fannin Street, Smith Tower, Suite 2500, Houston, TX 77030, USA; [b] Weill Cornell Medical College, New York, NY 10065, USA
E-mail address: joshuaharrismd@gmail.com

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NORMAL CAPSULE ANATOMY

The hip is a deep, constrained, diarthrodial synovial joint, surrounded by a thick musculotendinous soft tissue envelope. Although the capsule seems to dichotomize hip anatomy into 2 compartments, intra-articular and extra-articular, the layer concept of hip anatomy describes a method to determine the sources of hip pathology and subsequent treatment.[1] The osteochondral layer, layer I, provides the basis for arthrokinetic motion via joint congruity. Hip motion is primarily rotational, around a center of rotation, rather than translational.[2] Within layer I, loss of head-neck junction sphericity (cam FAI), femoral head overcoverage (pincer FAI) or undercoverage (dysplasia), and extra-articular impingement (anterior inferior iliac spine [AIIS] subspine impingement, trochanteric-pelvic, ischiofemoral) may all disrupt normal joint mechanics (translation in addition to rotation). Other osseous femoral (version, neck-shaft angle), acetabular (version, depth), and lumbopelvic (pelvic incidence, sagittal and coronal plane balance) parameters play a significant role in evaluation of layer I anatomy and pathology.

Layer II is composed of the inert, noncontractile soft tissue structures in and around the hip, including the labrum and the capsule. Although the fibrocartilaginous labrum provides a joint-stabilizing suction seal during motion, the capsule provides a joint-stabilizing checkrein to both translational and rotational ends of range of motion. Both structures resist femoral head axial distraction out of the acetabulum. The capsule is composed of 4 discrete ligamentous structures: iliofemoral (anterior), ischiofemoral (posterior), pubofemoral (inferior), and zona orbicularis (circumferential at head-neck junction). The iliofemoral ligament is the strongest of the 4 and is transversely cut during interportal capsulotomy (anterolateral [AL] to midanterior) in hip arthroscopy.[3] The latter permits excellent viewing of the central compartment: labrum, acetabular rim, articular cartilage of the acetabulum and femoral head, fovea, and ligamentum teres. A *T* capsulotomy, perpendicular to the interportal capsulotomy, permits excellent viewing of the peripheral compartment: proximal femoral head-neck junction, zona orbicularis, lateral and medial synovial folds, and lateral ascending vessels. Several biomechanical investigations have illustrated the importance of the iliofemoral ligament for retention of normal hip kinematics: Iliofemoral ligament sectioning (unrepaired capsulotomy) leads to increased external rotation, extension, and anterior and distal translation (**Table 1**).[4–9] An unrepaired *T* capsulotomy may potentially leave the hip catastrophically unstable (dislocation) or prone to microinstability due to a disrupted "stability arc."[10] The "stability arc" is a defined area of the anterior hip, defined by the medial and lateral limbs of the iliofemoral ligament as the static deep border and the iliocapsularis and rectus femoris as the dynamic superficial medial border and the gluteus minimus as the dynamic superficial lateral border (**Fig. 1**A).[10] In the setting of an unrepaired *T* capsulotomy, hip extension and external rotation dynamically pull the medial and lateral limbs of the iliofemoral ligament apart and evade the anterior stabilizing effect of the anterior capsule due to the pull of the iliocapsularis and gluteus minimus (layer III structures), respectively (see **Fig. 1**B). Layer III consists of the dynamic musculotendinous units in and around the hip and pelvis. This layer includes the muscles whose action is to move the hip, the lumbopelvic stabilizing girdle, and the pelvic floor. Layer IV is composed of the neurokinetic layer, the thoraco-lumbo-sacral plexus, and lumbopelvic tissues, serving as the neural link to the hip and lower extremities.

CAPSULAR PATHOPHYSIOLOGY

There are 2 settings in which capsular deficiency may exist: iatrogenic and native. Iatrogenic capsular insufficiency may exist in patients having undergone hip arthroscopy with an unrepaired capsulotomy (**Fig. 2**).[11] As the interportal capsulotomy directly incises the iliofemoral ligament perpendicular to the line of its fibers, if left